

## 1- AR App Info

EON-XR is an augmented and virtual reality application that supports remote learning by providing a hands-on experience. By offering the opportunity to explore 3D models such as cells, trains, and organs in 360-degree environments, it creates a different learning style for its users and also supports the creation and uploading of these models as courses.

After clicking on the lesson of interest, users are greeted with a message that helps them to place the 3D object in the camera. After placing the object correctly according to the camera angle, the buttons seen in Figure 1 welcome the users.

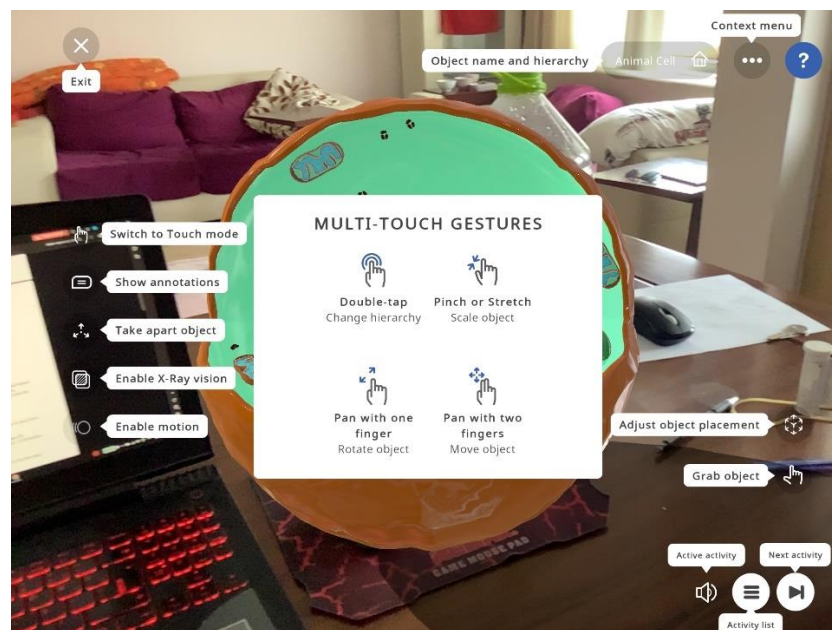


Figure 1

Through these buttons, the user can divide the object into pieces as much as enabled by the creator and access notes/videos/audio recordings associated with different components of the object. In addition to the didactic materials in the course, there are quizzes to reinforce the topics learned. Some of these quizzes also show the user's performance. The results are observable in Figure 2.

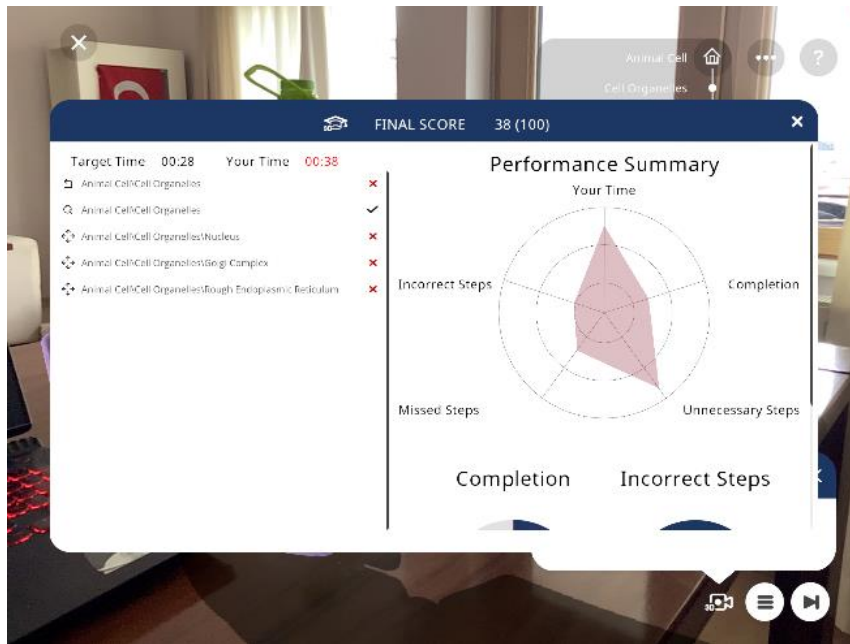


Figure 2

How long it takes to complete the course varies depending on the content of the course, the user's knowledge level, and the application experience. In the course named "Animal Cell" in the XR Library, there are a total of 27 components to be completed, including 18 audio, 2 locate, 3 videos, 1 identify, 1 pdf document, 1 quiz, and 1 image. In addition to these components, there are 5 3D interactions that allow the user to explore the 3D model, that is, parts that users can touch and drag. A person who is experienced in the application and knowledgeable about the subject can finish the course called "Animal Cell" in half an hour. However, for someone like me who is not knowledgeable about the subject and is using the application for the first time, this time increased to 45 minutes. It is also worth considering that I spent more time exploring the 3D model and application rather than just dealing with the tests and the information provided since it was my first time and out of curiosity.

## 2-Heuristics Evaluation

In this report, the two-pass evaluation strategy benefiting from Nielsen's 10 Heuristics is applied. In the first phase, a general review to identify obvious usability issues will be expressed to readers. In the second phase, a detailed review of each heuristic to pinpoint specific issues and propose solutions will be given.

- **Phase 1**

One of the first problems that stand out in practice is the lack of adequate guidance. If the "question mark" button is pressed, a screen with one/two-word explanations of the buttons greets users. However, as a user, instead of noticing this question mark and clicking it, I tried all the buttons one by one and learned it myself. The question mark in the upper right corner of the screen was the last button I noticed and clicked. For this reason, I discovered the application by listening to my own instincts rather than the guidance given to me.

On the screen with the directions of buttons, I found the explanations given about the buttons missing. Since the application offers a different environment, unlike the 2D online experiences I was used to before, the one/two-word explanations given for each button seemed inadequate to me as a user in this context. Because just by looking at these explanations, it would not be possible for me to understand the functions of the buttons without experiencing them myself or seeing how they are used.

Another issue that poses a problem is the "Enable Motion" button at the bottom left of the screen. Although this button is unusable throughout the lesson, it continues to occupy space on the screen. I explored different parts of the program and looked for an interface where this button was clickable. Even though I entered other courses as well, I could not find an interface where this button was activated.

The purpose of attending the course is to gain learning by exploring the given 3D object and completing the materials. However, once the materials are completed, there is no feedback to the user. On the contrary, when the user wants to leave the course, he can view the number of materials he has completed. As the importance of the visibility of system status, which creates a trustable communication between user and app (Nielsen, 2024), is considered, EON-XR fails in that sense.

- **Phase 2**

<b>Heuristics</b>	<b>Explanation of the Problems (Add related visuals of problems from screenshots)</b>	<b>Propose Solution(s)</b>	<b>Seriousness of each problem. (Low, Middle, High) Why?</b>

<b>Visibility of system status</b>	<p>1) The application does not show the number of activities, completed, in the main screen. There are two ways of to learn that. In the first one, users can see that by counting the approval signs, which can be seen in Figure 3. In the second way, when users want to exit from the lesson, they will be able to see that number without need of counting them, visible at Figure 4.</p>	<p>1) The total number of activities completed (numerator) and the total number of activities that need to be completed (denominator) can be displayed as a fraction in the upper right corner of the screen.</p>	<p>1) High. Because one of the main components of the learning process of the application is completing the assigned tasks. If the tasks that have been completed and need to be completed are not indicated to the user in a clearly visible place, the user will feel like he is not making progress. This prevents "open and constant communication", which is the basis of every relationship (Harley, 2018).</p>
<b>Match between system and the real world</b>	<p>1) The "home icon" next to the "Animal Cell" text at the top right of the main screen is used in a different sense than it is normally used. The home icon is normally used in applications to allow users to turn back to the home screen. Here, it has deviated from the general</p>	<p>1) The house icon next to the "Animal Cell" text can be removed and the existing text can be kept as a button.</p>	<p>1) Low. Because it is adequate for the user to click on that button once or twice to realize that the home icon is not used as it is generally used. Although it poses a problem, it cannot be said to be a</p>

	usage and is used as an "undo" between the components on the screen. It should not be forgotten that individuals' mental models are based on their real-life experiences as well as their previous digital experiences (Kaley, 2018).		problem that consumes a lot of time for users.
<b>User control and freedom</b>	1) When the different parts in the 3D model are separated by the user, as seen in Figure 5, the user has 2 ways to reassemble the parts. The first of these is to combine all the pieces one by one by pressing the "finger icon" on the right. The second solution is to reposition the model in the camera. It is possible that the user may perform this separation by mistake. Because in the type of activity called "Locate", the user is asked to select the desired pieces one by one. It is important to have a button that resets the model so that the user who finishes this activity	1) Adding a button that makes the model turn back to its initial state can solve this problem. Thanks to this button, the user can quickly solve his problem with one button, instead of combining objects one by one or realigning the camera.	1) Middle. Solving this problem will save the user time. It would be correct to group this problem as "Middle" since it solves an actional problem, which is expected to be done by users by mistake. It would not be correct to classify it as "High" since, like the other problems listed, it does not have a direct impact on the learning process, which is the main motivation of the application.

	"Locate" can make the model to turn back its initial state.		
<b>Consistency and standards</b>	1) There is an internal consistency problem such that there are two finger icons that stand for different functionalities.	1) Since they stand for different functionalities, one of them should be represented with a different icon. The finger button used to undo the "AR" operation on the left can be represented by another icon related to the "AR" concept.	1) Middle. It will not take long for the user to realize that although these two buttons are represented in the same way, they have different functionalities. Therefore, it cannot be said that it constitutes an emergency situation in terms of time to be saved for regular users. However, all user types should be considered when designing the interface. People diagnosed with ADHD (Attention-deficit and hyperactivity disorder) may constantly confuse these two buttons. This will pose a big problem for such users. This user type

			moves the problem from "Low" to "Middle".
<b>Error prevention</b>	1) There are many buttons on the screen. This increases the possibility that the user will take a different action than he intended by clicking on a button that he does not actually want. In these "slip" situations, there is a lack of an error message that will warn the user or an undo button to take the last action back.	1) There should be an "undo" button to take every possible action to the previous state.	1) High. Considering the number of buttons on the screen, it seems very possible for the user to make a mistake. For this reason, there must be a button to prevent these mistakes. So that, the user can save time and continue the learning process without considering application issues. The existence of such a button will have a direct impact on the learning process, as it will save more time than others. For this reason, it would be more accurate to give the priority level as high rather than medium.

<b>Recognition rather than recall</b>	It seems there is no issue related to "recognition rather than recall". All buttons are collected in a frame visible to the user. Therefore, as the user spends more time with the application, his familiarity with the buttons will increase at the same rate.	-	-
<b>Flexibility and efficiency of use</b>	Accelerators and customization are the factors that increase the flexibility and efficiency of use. However, there does not seem to be such a need in this application, as there is no complex structure other than buttons.	-	-
<b>Aesthetic and minimalist design</b>	1) The "Enable Motion" button, located on the left side of the screen and at the bottom, occupies space on the screen even though it is never used throughout the course.	1) This button should be removed from the screen and kept on the screen only in courses where it is available.	1) Middle. Because compared to the other problems, mentioned, it does not constitute a "high" level of issue. However, since it occupies the screen throughout the entire course, it negatively affects the user experience and is distracting.



<b>Help users recognize, diagnose, and recover from errors</b>	<p>There was no error message in the application</p> <p>Therefore I have not faced one.</p>	-	-
<b>Help and documentation</b>	<p>1) An application involving 3D modeling is unusual in an industry where 2D applications dominate. Therefore, clicking on a question mark icon and providing information about the buttons is a weak approach in terms of documentation. The assisting documentation should be enhanced in a way that users can understand how to use the program clearly and faster.</p>	<p>1) There should be a training process prepared for users who use the application for the first time. During this training, the use of the buttons must first be demonstrated and then done by the user. In this way, the user can test the functions of the buttons one by one with the help of an assistant and adapt to the application more quickly.</p>	<p>1) High. Since it is not a usual system, it is obvious that some additional explanation is needed (at least for users like me). It should be seen as a must, for the app, to have a training session before starting to use the application.</p>

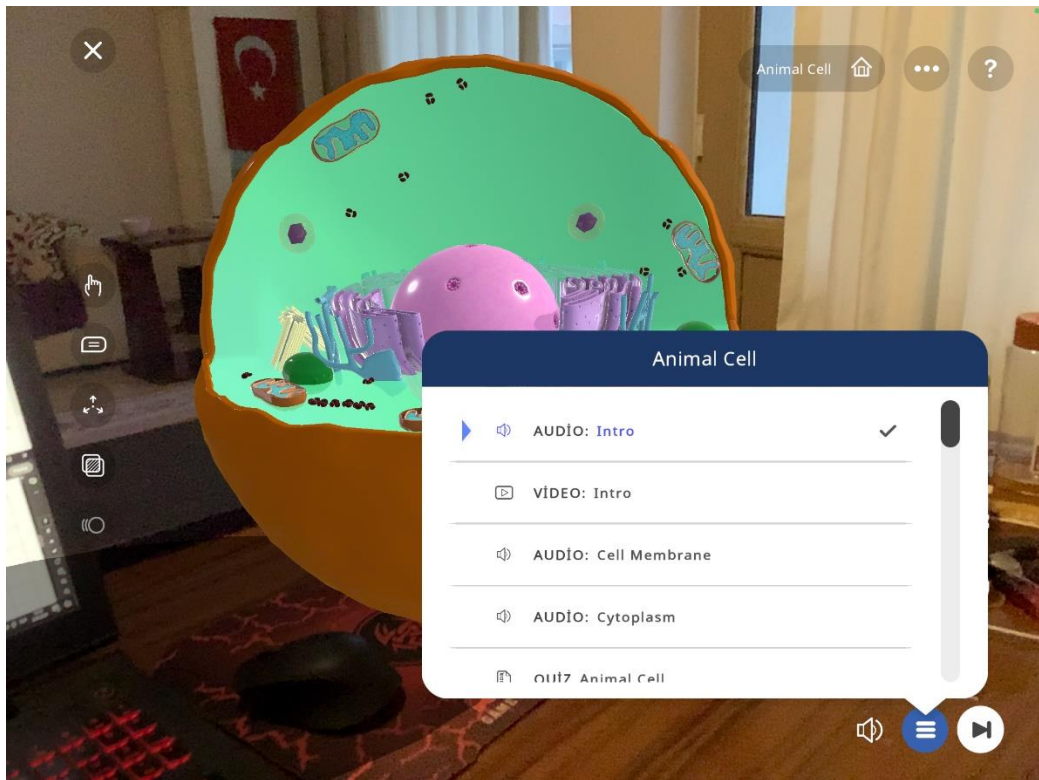


Figure 3

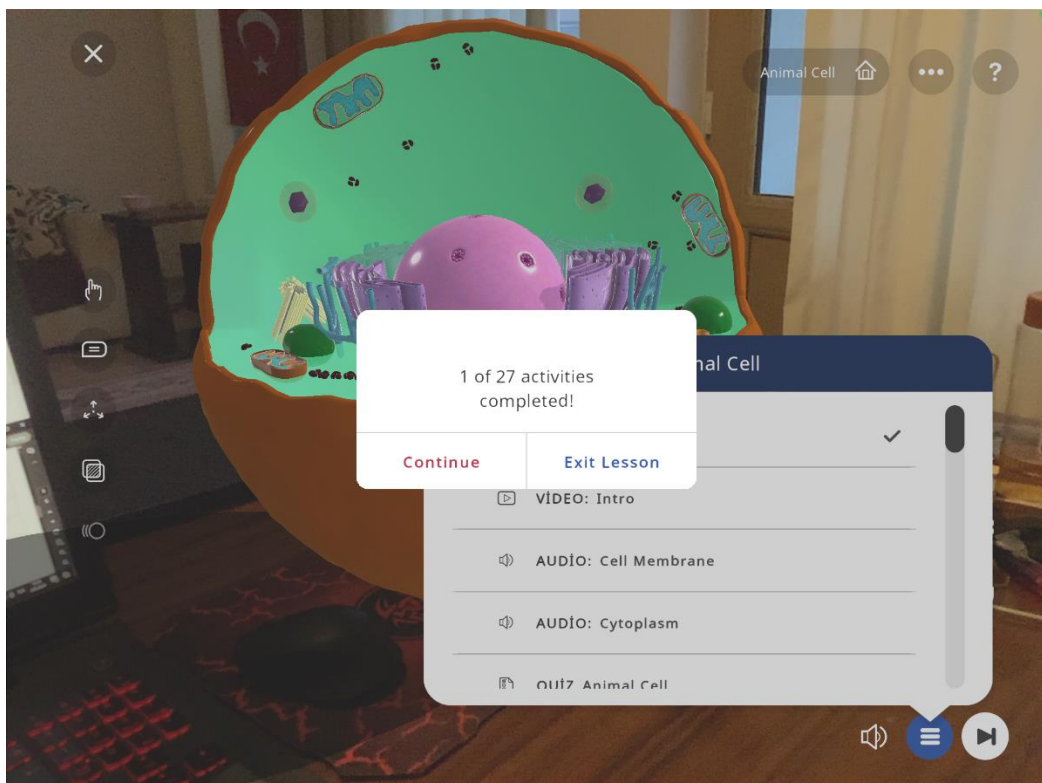


Figure 4



Figure 5

## References

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